

# Exterior Angles in a Triangle

An *exterior angle* of a triangle is formed when one of the sides is extended. An exterior angle lies outside the triangle. In this investigation you'll discover a relationship between an exterior angle and the sum of the measures of the two remote interior angles.

## SKETCH AND INVESTIGATE

Press and hold the pointer on the **Segment** tool and drag right to choose the **Ray** tool.

Select, in order, points  $B$ ,  $C$ , and  $D$ . Then, in the Measure menu, choose **Angle**.

Choose **Calculate** from the Number menu to open the Calculator. Click a measurement to enter it into a calculation.

Select the vertices; then, in the Construct menu, choose **Triangle Interior**.

Select point  $A$  and point  $C$  in order; then, in the Transform menu, choose **Mark Vector**.

Select the interior; then, in the Transform menu, choose **Translate**.

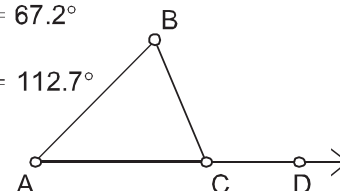
Double-click the point to mark it as a center. Select the interior; then, in the Transform menu, choose **Rotate**.

1. Construct  $\triangle ABC$ .
2. Construct  $\overrightarrow{AC}$  to extend side  $\overline{AC}$ .
3. Construct point  $D$  on  $\overrightarrow{AC}$ , outside of the triangle.

$$m\angle CAB = 45.5^\circ$$

$$m\angle ABC = 67.2^\circ$$

$$m\angle BCD = 112.7^\circ$$



4. Measure exterior angle  $BCD$ .
5. Measure the remote interior angles  $\angle ABC$  and  $\angle CAB$ .
6. Drag parts of the triangle and look for a relationship between the measures of the remote interior angles and the exterior angle.

**Q1** How are the measures of the remote interior angles related to the measure of the exterior angle? Use the Calculator to create an expression that confirms your conjecture.

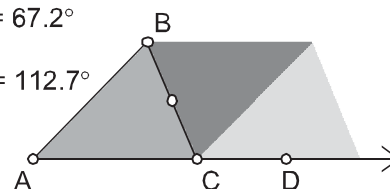
Follow these steps to see why your conjecture is true.

7. Construct the interior of  $\triangle ABC$ .
8. Mark  $AC$  as a vector.
9. Translate the interior by the marked vector.
10. Give the new triangle interior a different color.

$$m\angle CAB = 45.5^\circ$$

$$m\angle ABC = 67.2^\circ$$

$$m\angle BCD = 112.7^\circ$$



11. Construct the midpoint of  $\overline{BC}$ .
12. Mark the midpoint as a center for rotation and rotate the triangle interior about this point by  $180^\circ$ .
13. Give this new triangle interior a different color.

**Q2** Explain how the two angles that fill the exterior angle are related to the remote interior angles in the triangle. Explain how this demonstrates your conjecture from Q1.